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ABSTRACT

This study sought to determine whether language interference would have a significant effect on visual perception and whether the effect would be more noticeable for boys than for girls. For this cross-cultural study, second-grade pupils were employed. One group of 59 resided in Puerto Rico; the second group of 63, in New Jersey. The sample groups were matched in group means in chronological age and reading and spelling grades. In addition to their regular course of elementary school studies, the Puerto Rican children had been instructed in aural-oral English skills for 2 years. Both groups used the manuscript form of writing only. All subjects were administered the Figure and Ground Test from the Holmes-Singer Language Perception Tests, Series E-J, to determine any significant differences in visual perception. The 2 x 2 factorial with unequal n's revealed no statistically significant differences between the two groups. In the ANOVA performed, no significant difference was noted between the performance of boys and girls. Test materials, tables, and a bibliography are included. (Author/AW)

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This study sought to determine whether language interference would have a significant effect on visual perception and whether the effect would be more noticeable for boys than for girls. For this cross-cultural study, second-grade pupils were employed. One group of 59 resided in Puerto Rico; the second group of 63 in New Jersey. The sample groups were matched in group means in chronological age and reading and spelling grades. In addition to their regular course of elementary school studies, the Puerto Rican children had been instructed in aural-oral English skills for two years. Both groups used the manuscript form of writing only. All subjects were administered the Figure and Ground Test from the Holmes-Singer Language Perception Tests, Series E-J, to determine any significant difference in visual perception. The 2 x 2 factorial with unequal n's revealed no significant difference between the two groups ($F = 3.92$, $df = 1,118$; $p < 0.05$). In the ANOVA performed no significant difference was noted between the performance of boys and girls.

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LANGUAGE INTERFERENCE AND VISUAL PERCEPTION FOR NATIVE AND PUERTO RICAN SPEAKERS OF ENGLISH IN SECOND GRADE

A THESIS

SUBMITTED TO THE FACULTY

OF THE GRADUATE SCHOOL OF EDUCATION

OF

RUTGERS UNIVERSITY

THE STATE UNIVERSITY OF NEW JERSEY

BY

CLARE T. GOLAZESKI

IN PARTIAL FULFILLMENT OF THE

REQUIREMENTS FOR THE DEGREE

OF

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NEW BRUNSWICK, NEW JERSEY JUNE, 1971

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CHAPTER I

THE PROBLEM

Background of the Problem

One's native language seems to be acquired effortlessly: the baby babbles, grows selective in the sounds he utters, joins them into sequences used by the speech community in which he lives, phrases his sound sequences into structural patterns, and intones, stresses, and joins them into meaningful utterances which show that he has indeed become a member of his language community. And so, following five or six years of this speech development, the child enters school to be taught the more complex and representational language skills of reading and writing.

The individual who must learn another language must also master audio-lingual skills. Here the parallelism of language acquisition ends. The individual does not have five or six years to master these skills. He is usually of school age and perhaps has moved to a new language community where his needs are immediate. There is an urgency rather than any spirit of play to the learning. His educational progress will practically cease while he learns to communicate again. His native language now

causes interference in the learning of another. He must learn to hear and to speak sounds he has deleted from his memory. He must use sequences of sounds which are unfamiliar. The intonation, stress, and junction of new speech patterns are also difficult. Such is the language interference of the native language upon the second.

Varying opinions are held for coping with the interference problem in teaching a second language. Moulton (1966) stresses the importance of practice in listening to and speaking a language before any visualization of its coding is attempted, regardless of the background, training, or previous experience of the learner. Weinreich, on the other hand, notes:

> The visual reinforcement in the use of a language that a bilingual gets by reading and writing it may put that language in a dominant position over a purely oral one. The generally accepted notion that visual aids reinforce language learning finds support in two cases in which Swiss bilinguals recovering from aphasia regained the use of standard German and French respectively, before their native Schwyzertutsch [1963, pp. 75-76].

Linguistic differences do exist which might cause visual perceptual difficulties. Even when alphabets used for encoding languages are similar, sequential letter patterns differ. For example, while the most common two-letter words in Spanish are spelled en, la, de, lo, el, and se, the English are of, to, in, it, is, be, as, at, so, we, he, by, an, go, us, and if (Smith, 1943,

pp. 153-155). Are such linguistic differences sufficient to cause perceptual ones? Both Hallowell and Rivers, as reported by Segall, Campbell, and Herskovitz (1966) found differences in perception which seemed to be linked to linguistic differences--the former in Rorschach inkblot interpretations and the latter in color perception among Eskimos, Australians, and New Guinean tribesmen.

Statement of the Problem

The purpose of this study was to determine whether a difference existed in the visual perception of pupils in second grade who are learning English as a foreign language and pupils whose native language is English. In addition, the study sought to learn whether any difference found would be more significant for boys than for girls.

Statement of the Hypotheses

The following hypotheses were formulated:

1. Language interference affects visual perception as demonstrated by performance on the Figure and Ground Test from the Holmes-Singer Language Perception Test.

2. The effect of language interference on visual perception will be greater for boys than for girls.

Operational Definitions of the Variables

Language is defined as "a distinctly human system of behavior based on oral symbols which is used to describe, classify, and catalogue experiences, concepts, and objects [Spencer, 1964, p. 377]." It is so unique to a community that a member of another speech community is unable to communicate within it. Two such language communities were utilized in the study: a Spanish and an English. Although the two use the same alphabetic systems, their symbols and their sounds are strung together into sequences which are unintelligible to one another.

English as a native language was the language used by the segment of the experimental population residing in New Brunswick, New Jersey. This was the language of their speech community, used in social communication and for educational instruction.

English as a foreign language was the language being learned by the segment of the experimental population residing in Puerto Rico. It is classified as foreign because it was being learned while the subjects were living within their own speech community. While having the Spanish language for social communication and educational instruction, they were receiving one-half hour of daily instruction in aural-oral English. They had not yet been introduced to the reading and writing of English. Such

instruction was not introduced until the third grade of school. The aural-oral phases were introduced in the first grade. The pupils, then, were in their second year of formal foreign-language instruction.

Language interference is a difficulty experienced by foreign-language learners in that the set of rules they have learned which governs their native language conflicts with the set of rules governing the second language.

Visual perception is the ability to recognize and identify objects in the foreground and background and to separate them meaningfully. In this study the ability was demonstrated by tracing the form identified in a dot configuration.

Affect means modify in such manner that because of language interference one group will commit more errors than the other.

These definitions are limited only to this study, in the sense of the context, and to the population used.

Significance of the Study

The investigator was interested in determining whether a significant visual-perceptual difference existed between those learning a foreign language and those who utilize only their native language. Results were considered to be important in determining teaching modalities in second-language learning.

Kinesthetic, auditory, and visual are modalities by which individuals learn. Each person is thought to develop a preferential modality. Presently in second- and foreign-language teaching it is recommended that the aural-oral language skills be well established before visual-graphic language representational skills are introduced.

While individuals learning a foreign language have the luxury of time for mastery of the various language skills, those learning a second language are frequently in the upper grades of school. Although the audial-lingual method is used much of the time in early classroom education, more sophisticated educational experiences of the upper grades require an emphasis of the visual-graphic. Should language interference prove to be a significant factor in visual perception, there is indeed justification in withholding the latter skills. However, should the contrary appear to be true, one would wonder whether an almost simultaneous introduction of the encoded materials would not be a valuable aid to language acquisition for those whose learning preference may be the visual modality.

CHAPTER II

REVIEW OF LITERATURE

Literature in the area of perception was reviewed for the purpose of determing its characteristics, its importance to reading, and its relationship to culture.

Characteristics of Perception

Perception is a physicalistic and a phenomenological process by which an organism interacts privately with his environment. Through sight, for example, visual perception occurs. The subject sights a target or stimulus with the sight organ, the eye; and depending upon the precision of that organ, the neural impulses conveyed, and the past experiences of the individual, evaluations of the stimulus are made. These evaluations or perceptions are private in that an observer has no other means of studying them except through the individual's oral or graphic report--symbolic substitutes for the perceptual experience.

Although agreeing on the physicalistic and phenomenological aspects of perception, theoreticians are divided on its molar or molecular attributes. Gestaltists, represented by such theories as Tolman's sign-gestalt expectancy

and Lewin's topological field, support the former. Hebb's cell assembly and phase sequence, Ames's transactional, Bertalanffy's general open systems, and Holmes's substrata factor are theories representing the latter. Allport (1955) illustrates the difference between those supporting a molar doctrine and those espousing a molecular doctrine as being comparable to a recognition of the organism as a whole (a man running) or an analysis of the parts of the organism (the legs, body, muscles, etc., contracting and extending for a running movement). Similarly, in visual perception there is a recognition of the stimulus for the molarist, but for the molecularist there is an evaluation of the stimulus based on such elements as acuity, accommodation, and prior context. There are incorporations of larger and larger patterns for perception to occur. According to Bartley (1958) the experience of figure-ground dichotomy, for example, is thought to be primary in perception.

On one perceptual characteristic especially, that of complexity, experts are in agreement. They define perception as more than simply recognition of the object shape striking the retina. Bruner (1958, p. 695) defines perception as "a process of categorization in which organisms move inferentially from cues to categorical identity . . . and in many cases the process is a silent one."

Woodworth and Schlosberg (1954) report that on analysis the perception of objects proves tc be a very complicated process involving many different sensory elements as well as the effects of past learning. They state that something more than the reception of the stimuli by the retina must occur before certain parts of the mass separate out from the rest and appear as a definite shape such as a circle or a straight line. Perception, to them, identifies the result achieved by the organism, not the process of achieving the result.

Allport (1955) was interested in the perceptual process; for, to him, perception was a process by which the individual gained a recognition, an understanding, and a basis for reacting to the environment in which he found himself. That process he divided into six broad categories. These were quality, figure and ground, perceptual constancy, dimensional frame of reference, concrete object character, and the effect of the prevailing set or state.

The first class, quality, pertains to sensory qualities and dimensions which constitute one general aspect of the way things appear to us. These are qualitative experiences which endure through time or which may be modified by the conditions or surroundings under which they are observed.

The second, figure and ground, are defined as

aspects of perceptions since, in every sense modality, our world consists of figures appearing against grounds.

The third division, perceptual constancy, is a constancy of appearance which is preserved for us despite tilt, angle, or position. We thus have a means for recognizing and identifying objects.

The fourth, the dimensional frame of reference, occurs when the subject is faced with the need to give absolute dimensional judgments. In a series of bright spots, for example, the individual forms his own subjective scale of judgment, such as: neutral, dim, bright.

The fifth class, concrete object character, is defined as having things and events appear not as mere qualities, dimensions, or forms, but as things and events. Thus, in repeated lengthening exposures, a red dot is gradually perceived as a red apple.

The final or sixth class, the effect of the prevailing set or state, is defined as the manner in which the particular attitude of an individual may affect the selection of objects and the readiness with which objects may be perceived. The "set to perceive may be based on nothing more dramatic than the frequency and familiarity of the object in the observer's experience [Allport, 1955, p. 65]."

Allport explains that the first three of the

categories: quality, figure and ground, and perceptual constancy, would likely hold true for all individuals at all times; the fourth and fifth, dimensional frame of reference and concrete object character, would hold true for individuals of similar backgrounds; and the sixth, the effect of the prevailing set or state, would be affected by individual differences and the state of the individual.

Because the present study utilized figure and ground as the means for gathering data concerning visual perception, differences between the two elements, figure and ground, were studied. E. Rubin (1958) listed the differences as follows:

1. The figure has form while the ground is relatively formless; or if the ground has form, it is due to some other figuration upon it and not to the contour separating it from the figure.

2. The ground seems to extend continuously behind the figure and not to be interrupted by it.

3. While the ground appears like unformed material, the figure has some of the character of a thing.

4. The figure tends to appear in front; the ground, behind.

5. The figure is more impressive, better remembered, and more apt to suggest meaning.

While Rubin explained the differences between

figure and ground, Wertheimer (1958) determined that the following factors were important in the organization of a figure:

1. Nearness or proximity in the field of view. Dots relatively close together are readily seen as a group.

2. Sameness or similarity. Dots of the same color or shape are seen as a group.

3. Common fate. Dots moving simultaneously in the same direction are seen as a group.

4. Good continuation or good figure. The closed line has an advantage over an open one.

5. Conformity with the individual's momentary set. The observer can set himself for a certain grouping and so resist the factors of proximity and similarity.

6. Past experience or custom. A series of words though printed without spacing will be separated and read. To prove the reality of the experience factor, one must show that the more direct perceptual factors do not account for the grouping obtained. Certain integrations and divisions can, however, be produced by habit or experience.

This last element has been investigated by Bruner and Postman (1958). They reported in a study of 28 college students shown incongruous playing cards inserted

serially among normal playing cards that more exposure time (t = 3.76, p < 0.01) was required for recognizing "trick cards" than the normal ones. It was found that prior experience with normal cards did not lead to a better recognition of incongruities, although there was some recognition of incongruity or disruption of organization in the verbal descriptions of the cards. They concluded that perceptual organization is powerfully determined by expectations built on past experience with environment.

Importance of Perception to Reading

That perception is important in the reading act is demonstrated in Posner and Keele's study (1969) of decay of visual information from a single letter. They determined that visual information from a single letter is preserved in a trace while a second letter is being projected. The investigators, who used 12 college males, concluded that immediate identification of a sequential letter is impeded if it is not physically the same letter as that leaving the trace. Chao, writing in a similar vein, states that "even under normal 'quiet' conditions, the reception of symbols never occupies the whole field of attention, except during hypnotism [1968, p. 222]." This characteristic is evidenced by such errors as initial, medial, or final letter substitutions, so symptomatic of

reading disabilities.

In addition to accuracy in reading, Hamilton (1907) found that rate of reading decreased with a decreasing amount of perceptual organization for both children and adults. Also, on the basis of 50 percent of letters tachistoscopically projected having been incorrectly identified resulting in word substitutions, he further theorized that a greater percentage of letter recognition is requisite to correct word perception, especially if words are strange or unfamiliar, because "in ordinary reading not all the impressions received during a reading pause are interpreted correctly at that moment [Hamilton, 1907, p. 23]."

Barrett (1965-1966), in reviewing studies of the relationship of visual discrimination and reading achievement, found the visual discrimination of letters and words to have a higher predictive relationship with first-grade reading skills than discrimination of geometric designs and pictures. Visual discrimination appeared to have universal acceptance as an index of reading readiness and as a predictor of success in learning to read.

Nila B. Smith (1928), too, in one of the earliest studies to consider visual discrimination as an avenue for predicting reading success, concluded after studying 200 subjects that letter matching could be used as a good

predictor of reading readiness.

Weiner and Feldmann (1963) found identification of letters (r = 0.70) to have a somewhat closer relationship with later reading achievement than matching words (r = 0.61). Their findings were based on data obtained through testing 126 primary-grade children in the matching of letters and three- and four-letter words.

In Della-Piana (1968), Dykstra is said to have found letter naming to be the best single predictor of success in beginning reading, while DeHirsch and others determine it to have yielded the highest correlation with overall reading performance for end of second-grade reading (r = 0.55).

Holmes (1965), whose figure-ground test was used for the study, found the results of such a test to have an associational impact of the lower upon the higher substrata factors in the power of reading. His substrata-factor theory visualized a test score as representing a sample of the functional processes from the interacting systems which were built from different subsystems containing highly related bits of information. His associate in the test, Singer (1965) found the figure-ground configuration to have a 0.66 correlation in predicting speed of reading with third to sixth graders.

Gibson, Pick, Osser, Hammond, and Hammond (1962)

designed an experiment to learn whether structural redundancies facilitated perception. Pseudo-words, both pronounceable and unpronounceable, were projected tachistoscopically to college students. The investigators found a significant difference in exposure times required for the recognition of items in the two sets. Pronounceable letter sequences found in English spelling patterns functioned as units in perception even when they were used to form meaningless nonsense syllables.

Using children completing the first and third grades in a somewhat related study, Gibson, Osser, and Pick (1963) projected, tachistoscopically: three-letter words and pronounceable and unpronounceable trigrams. They were recognized by the first graders in that order of accuracy. At the third-grade level many children perceived all forms with equal accuracy.

Rystrom (1969) also suggested that children do not distinguish between letters adequately until the third grade. In his study using 93 primary-grade children, significant difficulty ($p < 0.05$) in identifying allographs of graphemes in a multiple-form letter discrimination test (ex., M Q a A) was found.

Rouch (1969) found visual tasks in a figure-ground test to have a positive relationship to early reading achievement, especially for boys, regardless of reading

instructional method. In studying the relationship of visual discrimination to performance in beginning reading, two differing instructional methods had been used.

The frequency of occurrence with which a verbal unit has been experienced in the past history of an individual and its effect on immediate recall were examined by Korn and Lindley (1963). They determined through tachistoscopic projection that consonants of high frequency order were recalled more accurately than consonants of low frequency order. The nine consonants of highest frequency listed by them were T, N, S, R, H, L, D, C, F, and the lowest were G, P, B, V, K, X, J, Z, and Q. Ninety undergraduate subjects were used for their study.

Wallach (1963) had found familiarity to be a powerful determinant for ease of perceptual recognition with words ranging from a zero-order to a fourth-order approximation to English spelling.

Arthur Gates (1961) found that a greater proportion of boys received lower and more variable scores than girls in reading achievement. More than 12,000 children from 12 school systems and 10 states participated in his 1957 study. He attributed that difference to environmental factors rather than maturational ones.

Relationship of Perception to Culture

The results of the search into relevant cross-cultural studies of visual perception were disappointing in that they were primarily based on discrimination of colors, and most data were of an anecdotal rather than of an absolute nature. Yet even with studies in color perception there has been no resolution to the problem.

Among studies found which employed discrimination of stimuli other than colors was one using randomly arranged number lists. For that study, MacNamara and Krauthammer (1968) employed English students learning French, French learning English, and equally competent bilinguals. No significant differences were found in their naming of tachistoscopically projected numerals.

Ervin (1955), pondering whether shifts in the language of response would produce specifically predictable changes in content, analyzed the responses to a Thematic Aperception Test of 64 adult French bilinguals residing in the United States. She concluded that there were differences in speech content of the bilinguals to the pictures according to the language being spoken.

Malinowski (1927) studied the visual perception of the Trobriand Islanders. He reported that children were said to resemble their fathers but not each other. Strong resemblances were pointed out in proving physiognomic

similarities of sons to their fathers, yet no such similarities were found in the brothers. He concluded that a cultural influence on perception existed.

Michael (1953) conducted an investigation of Navajo Indians and non-Indian Americans using tachistoscopically projected circles which had incomplete circumferences of varying dimensions. Although the Indians had been culturally conditioned not to complete designs in their craft work, no significant differences were found in the performance of the two groups.

The present study attempted to determine whether the language of a community was associated with factors affecting perception which are deemed important in the reading act.

Summary

The literature in the area of perception was reviewed for its characteristics, its importance to reading, and its relationship to culture.

It was determined that many characteristics of perception had been identified. On some, there is agreement: its physicalistic and phenomenological processes, its complexity; on other attributes there is disagreement, the global versus the analytical, which results in opposing molar and molecularistic doctrines.

The studies reviewed in searching for the

importance of perception to reading suggested that a one-to-one correspondence between the stimulus and response was essential in the reading act and could be used for the predicting of reading success (Barrett, 1965-1966; Smith, 1928; Weiner & Feldman, 1963). A lack of such correspondence could suggest a relationship with lack of power in reading (Holmes, 1965) and lack of speed in reading (Hamilton, 1907; Singer, 1965).

The study of the relationship of perception to culture covered a broad range of cultural attributes: the naming of French and English numbers (MacNamara & Krauthammer, 1968), pride and self-respect through response to the Thematic Aperception Test (Ervin, 1955), family resemblance (Malinowski, 1927), and religious belief--the practice of non-closure by the Navajos (Michael, 1953).

The present study was not a replication of any of those reviewed. It was unique in that a figure and ground test was used with second-grade children, and was a cross-cultural study using residents of Puerto Rico and residents of New Jersey as subjects.

CHAPTER III

PROCEDURE

The chapter on procedure shall describe the sample groups, their matching, and the test results found in comparing the two groups. The task subjects performed shall also be described, together with the independent and dependent variables. Finally, the administration of the test and data analysis will be discussed.

Subjects

The subjects for the cross-cultural comparative study consisted of 122 pupils of the second-grade level. Fifty-nine of those pupils attended an elementary school located in a San Juan, Puerto Rico, public housing development; the remaining 63 were enrolled in a New Brunswick, New Jersey, public elementary school. Of the intact classes utilized for the study, two, consisting of 34 and 25 pupils, respectively, were from Puerto Rico; and three, consisting of 22, 20, and 21 pupils, were from the New Jersey school. Five pupils who were learning English as a second language in the New Jersey school were not used for the study. There were 29 boys (17 and 12) and 30 girls (17 and 13) in the Puerto Rican group; and 31 boys

(10, 10, and 11) and 32 girls (11, 10, and 11) in the New Jersey group. Appendix A gives a breakdown of the five classes included in the study.

Establishment of Matched Groups

Because intact groups rather than randomly selected samples were utilized, the standard error of difference of the means (Moroney, 1961) of their latest report card grades in spelling was computed. Their reading skills and chronological ages were also analyzed in this manner. Although the individual differences were not paired with each other in the two samples, the means, if not significantly different, could be regarded as paired at random (Ferguson, 1966).

In comparing the means of both groups, two standard errors between the means were regarded as significant. "A difference of more than two standard errors between the sample means is probably significant. A difference of three or more standard errors is regarded as definitely significant [Moroney, 1961, p. 220]."

Reading skills. For comparing sample means in reading, teacher classifications were converted to the following numerical values: very good = 5, good = 4, fair = 3, poor = 2, and nonreader = 1. To test for significance of difference between the means in reading ability

of the groups, these hypotheses were formulated: there is no significant difference in reading skill between the English as a native language (ENL) and English as a foreign language (EFL) groups, or a significant difference in reading skill exists between the ENL and EFL groups. With a mean of 3.52 and a variance of 1.2 for the Puerto Rican (EFL) group, and a mean of 3.22 and a variance of 1.3 for the New Brunswick (ENL) group, a difference of 0.30 between means was computed. The observed difference between the sample means, 0.30, which was 1.5 times its standard error of difference, 0.20, was not significant. The null hypothesis of no difference could not be rejected; the groups were considered comparable in reading skill. Table 1 displays the data computed.

Spelling skills. From Table 2 it can be seen that similar findings of no significance between the differences of the means were determined between the two groups in spelling skill. These hypotheses were formulated: there is no significant difference in spelling skill between the ENL and EFL groups, or a significant difference exists between the ENL and EFL sample groups. A mean difference of 0.22 was found when subtracting ENL mean, 2.98, from EFL mean, 3.20. Computing their combined standard variances of EFL variance, 1.164, and ENL variance, 0.95, led to a standard error of difference of 0.186. The

TABLE 1

TEST FOR DIFFERENCE OF MEANS BETWEEN ENL AND EFL SAMPLES IN TEACHER RATINGS OF READING SKILL

Source	New Jersey (ENL)	Puerto Rico (EFL)
Sum of scores	203	208
Number	63	59
Mean	3.22	3.52
Variance	1.3	1.2
Difference of means	0.30 not significant*	
S.E. of difference	0.20	

*For significance 2.0 (S.E.) needed. Observed 0.30 = 1.5 (S.E.).

TABLE 2

TEST FOR DIFFERENCE OF MEANS BETWEEN ENL AND EFL SAMPLES IN REPORT CARD RATINGS OF SPELLING SKILL

Source	New Jersey (ENL)	Puerto Rico (EFL)
Sum of scores	188	189
Number	63	59
Mean	2.98	3.20
Variance	0.95	1.164
Difference of Means	0.22 not significant*	
S.E. of difference	0.186	

*For significance 2.0 (S.E.) needed. Observed 0.22 = 1.18 (S.E.).

observed 1.18 times the standard error of 0.186 led to a rejection of the alternative hypothesis formulated for testing. For measuring spelling skills, letter grades of last report card issued were translated into numerical values. These were A = 5, B = 4, C = 3, D = 2, and F = 1.

Chronological ages. Table 3 contains data obtained when testing for significance of mean difference in chronological ages in months of the two groups. The hypotheses formulated for testing were that there is no significant difference in chronological age between the ENL and EFL groups, or a significant difference exists between the EFL and ENL groups in chronological age. Once again the null hypothesis of no difference could not be rejected when the observed difference between the means of 0.40 was computed to be 0.36 times the 1.092 standard error of difference. Other observed findings were a sum of scores of 5532 for EFL and 5882 for ENL. The means were 93.76 and 93.36, respectively. The variances were 47.0 and 25.0, in the same order. The difference between the means was found not to be significant.

Although pupil IQ's were not available, the subjects were thought to be of at least average ability inasmuch as they were functioning in regular classrooms. The groups were also believed to have been from similar lower

TABLE 3

TEST FOR DIFFERENCE OF MEANS BETWEEN ENL AND EFL SAMPLES ON CHRONOLOGICAL AGE IN MONTHS

Source	New Jersey (ENL)	Puerto Rico (EFL)
Sum of scores	5882	5532
Number	63	59
Mean	93.36	93.76
Variance	25.0	47.0
Difference of means	0.40 not significant*	
S.E. of difference	1.092	

*For significance 2.0 (S.E.) needed. Observed 0.40 = 0.36 (S.E.).

socioeconomic backgrounds.

Because the variables: reading skill, spelling skill, and chronological age, which were considered pertinent to the study had means which were not significantly different, the groups could be regarded as paired at random.

Task

All subjects were given a modified version of the Figure and Ground Test from the Holmes-Singer Language Perception Tests, Series E-J, Form A. This test consisted of 100 items in a 10 x 10 block arrangement on a single sheet of paper. Within each item block was obscured the form of a letter or numeral in a cloud of dots (see Appendix C.1 for Test Form).

Independent Variables

The English as a foreign language, or experimental, subjects had been instructed in their second language for two years. This instruction was limited to aural-oral skills. Their reading and writing skills were taught in Spanish only. No reading or writing of English was introduced into the program until the third grade.

Both groups were considered to have comparable histories since they attended school in their own language communities, had similar subjects, and were continuing to

use the manuscript form of writing only. The cursive form was introduced in both groups' school systems sometime during the third grade. Differences, then, because of language experience could be measured.

In addition, the investigator wanted to learn whether any significant difference found would be greater for boys than for girls.

Dependent Variable

The dependent variable, perception, was measured according to scores attained in a figure and ground test. To score the test, one point was allotted for each correct response in the 100-item test (see Appendix C.5 for method of compilation). Group scores were obtained by averaging individual scores. A total of 100 points was possible in an individual test (see Appendix B, Parts 1-4, for individual scores and Appendix C.6 for individual responses).

Administration of Test

The study was conducted during one day at each school. Teachers of the classes involved in the study were prepared for the administration of the test during the week prior to the test's administration. Teachers of the New Jersey subjects were made familiar with the test and its administration by the investigator. Those of the Puerto Rican group were oriented by a teacher in Puerto

Rico who had translated the instructions into Spanish (see Appendix C.3 for test directions for Spanish-speaking sample) and who also had trained in the teaching of English as a second language through courses taken at the University of Puerto Rico.

On the day during which the tests were administered to the subjects, test forms were distributed. Each child was given a wax crayon to use so that no erasures were possible. In that way, the subject's first response to a target percept became the recorded response. To record a response the subjects connected the dots of the figure perceived in order to illustrate its form (see Appendix C.4 for test answer key). During the test neither numerals nor alphabet letters were displayed in the classroom as an aid to the children.

One-half hour was given for completion of the tests.

The directions (see Appendix C.2 for test directions) for the test were a departure from those given in the Holmes-Singer test in that subjects responded directly on test forms rather than on separate answer sheets. The use of such sheets is thought to be confusing to pupils below the third-grade level. Time allotted for the test was also extended from 4 minutes to 30 minutes to permit the subjects sufficient time to complete the test.

Data Analysis

An analysis of variance with unequal n's in the form of a 2 x 2 factorial (Tuckman, 1970) was used to test the data statistically. In addition, the Guttman formula (Hill & Kerber, 1967, p. 289) was used for estimating the reliability of the test through a split-test method. A t test was performed upon the reliability.

Summary

Subjects for the cross-cultural study were selected from the second-grade level of public schools in San Juan, Puerto Rico, and New Brunswick, New Jersey. Matched groups were established by comparing the means of their reading and spelling grades and their chronological ages.

For obtaining data which could be subjected to statistical analysis, the subjects were administered a figure and ground test from the Holmes-Singer Language Perception Tests.

Test results were subjected to an analysis of variance for determining any significant difference in performance, a split-half reliability check, and a t test to check the significance of the reliability.

CHAPTER IV

FINDINGS AND DISCUSSION

For the purpose of analyzing data, a 2 x 2 factorial with unequal numbers (Tuckman, 1970) was utilized. One ANOVA was performed in testing for differences between groups and between sexes in visual perception.

Findings

The first hypothesis of this study was as follows: Language interference affects visual perception as demonstrated by performance on the Figure and Ground Test from the Holmes-Singer (1965) Language Perception Tests.

For a significant difference to be found at the 0.05 level for $df = 1$ and $df = 118$, the value of F required was 3.92; and for a significance at the 0.01 level, 6.84.

From Table 4 it can be seen that there was no significant difference between the ENL and EFL groups ($F = 1.455$, $df = 1,118$; $p < 0.05$). Since no significant difference in visual perception between the groups was found, the first hypothesis must be rejected.

The second hypothesis of this study was as follows: The effect of language interference on visual perception

TABLE 4

ANALYSIS OF VARIANCE OF PERCEPTION BY ENL AND EFL SUBJECTS AND BOYS (N = 60) AND GIRLS (N = 62)

Source	df	MS	F
Group means	1	230.354	1.455
Sex means	1	46.083	0.2912
Interaction	1	150.119	0.9485
Error	118	158.26	
Total	121		

$p < 0.05 = 3.92$.

$p < 0.01 = 6.84$.

will be greater for boys than for girls.

From Table 4 on visual perception it can be seen that there was no significant difference between the performance of boys and girls (F = 0.2912, df = 1,118; p < 0.05). For a significant difference to be demonstrated, the value of F required was 3.92 at the 0.05 level for df = 1,118; and for the 0.01 level, 6.84. Therefore, the second hypothesis of this study must be rejected.

The Guttman formula for estimating test reliability through a split-half method (see Appendix B.5 for split-half scores of subjects) yielded coefficients of correlation of 0.87 for ENL and 0.75 for EFL. Table 5 shows that with 61 df, and at the 0.01 level, two-tailed t = 2.39. The observed 13.67 for r = 0.87 was significant. For 57 df and t = 2.41, the observed 8.17 for r = 0.75 was also significant at the 0.01 level.

The findings derived from the study were as follows:

1. According to scores on the Figure and Ground Test of the Holmes-Singer Language Perception Tests there is no significant difference in visual perception between those who have English as a native language and those who are learning English as a foreign language.

2. This study shows no significant difference in visual perception between the sexes of those who have

TABLE 5

RESULTS OF t TEST UPON TEST RELIABILITY COEFFICIENTS

Group	N	df	r	t
ENL	63	61	0.87	13.67*
EFL	59	57	0.75	8.17**

*p < 0.01 = 2.39, 61 df.

**p < 0.01 = 2.41, 57 df.

English as a native language and those who are learning English as a foreign language.

Discussion

The pupil who has moved to a new linguistic environment has had disrupted his ability to communicate with his peer group as well as his ability to demonstrate previous learning. In addition to the disruption of his aural-oral skill, there is the disruption of his visual-graphic skill. To learn to speak a new language, an individual must acquire the skill of discriminating among and of reproducing sounds meaningfully. The set of rules governing that person's first language so impedes the acquisition of the second language that it has been designated as "language interference" (Weinreich, 1963). To learn to read and write the new language, the pupil must learn to string together different sequences of graphemes (Fries, 1963; Gibson, 1941; Miller, Bruner, & Postman, 1954; Smith, 1943). Even punctuation marks may have a unique placement and arrangement.

Yet, it appears as if having learned elements strung together into different sequences had no effect on the expectancies as assessed in the visual perception test of letters. This finding seems to concur with Allport's (1955) perceptual constancy category in the perceptual process--that despite changes in position, the target will

be identified. Perceptual constancy, then, may be extended cross-culturally, at least into language communities utilizing similar graphic encoding symbols, as a universal perceptual characteristic. The findings do seem to indicate that despite the emphasis of different organizations of alphabet letters because of unique (to their languages) sequential arrangements, both sample groups have attained the same perceptual level of identification with the individual symbols. Thus "different initial conditions may lead to an equivalent characteristic state [Kling, 1966, p. 80]."

The results of no difference would also seem to extend the "General Open Systems Theory" postulate of equifinality, cross-culturally in that "a final state may be reached from different conditions and/or different ways [ibid., p. 80]."

The universality of quality and figure and ground categories proposed by Allport (1955) also seems to be borne out by the study since there was no significant difference in grapheme allographs perceived by subjects. Where letters were recognized as capital letters by one group, they were recognized in similar manner by the second group. Then too, figures separated from the ground by certain dot patterns by the one group were seen as similar forms constructed by the same dot patterns by the

other group.

It was thought that the dimensional frame of reference and the effect of the prevailing set or state because of frequency of contact with a percept would affect its identity by the cross-cultural groups. However, these categories appear to be more limited in cross-cultural application to a point beyond which "certain more or less common cultural interrelationships . . . become common between unique persons [Ames, 1960, p. 81]."

Because of the findings of no difference in performance between groups or sexes, the Figure and Ground Test (Holmes-Singer, 1965), which is composed of individual rather than complex sets of organized elements, may be useful for identification of visual-graphic organization in the presence of cultural differences. "Printing and handwriting often reveal characteristics that are peculiar to the culture to which they belong [Brooks, 1966, p. 6]." The test does extract specific learning and specific ability from complex human beings who must exhibit an ability to separate figure from ground by connecting dots in ambiguous and clouded configurations. The study indicated that such an organizational ability seems to have been grasped by children as young as seven years of age. It may also be that learning of letters is well established by that age level and has already ceilinged out until a

new allograph set is introduced in the form of cursive writing, causing a lack of balance.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of this chapter was to summarize the study, state conclusions found regarding the hypotheses, list limitations, and suggest possibilities for further research.

Summary

The study was designed to determine whether language interference and visual perception were related as shown by performance on the Figure and Ground Test from the Holmes-Singer (1965) Language Perception Tests. More specifically a determination was to be made whether a significant difference existed between the visual perception of pupils who are learning English as a foreign language and those for whom English is the native language. In addition, the study sought to learn whether any difference found would be more significant for boys than for girls.

Fifty-nine pupils in Puerto Rico and 63 pupils in New Jersey comprised the 122 subjects used for the study. Performances of boys and girls were analyzed. All were second graders. The particular grade level was selected because the pupils had not yet been introduced to cursive

writing, and in that grade level the Puerto Rican group had not yet been introduced to the reading or writing of English.

For determining matching of the intact class groups, chronological ages in months and ratings on reading and spelling grades were subjected to statistical analyses. The results of the matching analysis showed no significant differences.

Although pupil IQ's were not available, the subjects were thought to be of at least average ability inasmuch as they were functioning in regular classrooms. The groups were also believed to have been essentially from a lower socioeconomic stratum. In addition, both groups were considered to have comparable histories since they attended public schools in their own language communities. In addition to the usual subjects taught in elementary schools, the Puerto Rican subjects had been taught aural-oral English skills for one-half hour daily for two years. Differences then because of language experience could be measured.

For the collecting of data all subjects were administered a modified version of the Figure and Ground Test from the Holmes-Singer Language Perception Tests, Series E and J.

A 2 x 2 factorial with unequal numbers (Tuckman,

1970) was used for analyzing the data. One ANOVA was performed in testing for differences between groups and between sexes in visual perception. No significant differences were found between groups or between sexes.

The Guttman formula for estimating test reliabilities through split-half methods approach yielded coefficients of correlation of 0.87 for ENL and 0.75 for EFL.

Conclusions

Conclusions made as a result of the statistical analysis were:

1. The null hypothesis that there is no significant difference in visual perception between those who have English as a native language and those who are learning English as a foreign language was upheld.

2. Because males did not demonstrate a marked effect compared to females, the null hypothesis that there is no significant difference in visual perception between the sexes of those who are learning English as a foreign language and those who have English as a native language was not rejected.

The results of no difference would seem to extend the "General Open Systems Theory" postulate of equifinality cross-culturally in that "a final state may be reached from different conditions and/or different ways [Kling, 1966, p. 80]." This study seems to indicate that despite

the emphasis of different organizations of alphabet letters because of unique (to their languages) sequential arrangements, both sample groups have attained the same perceptual level of identification with the individual symbols. Thus, "different initial conditions may lead to an equivalent characteristic state [ibid., p. 82]."

Limitations

The study's generalities are limited to the sampling, method, and test used.

Further knowledge is necessary in the relationship among the families of languages and of the relationships of the dialects within a language to extend the universality of the findings of the study.

Suggestions for Further Research

It is recommended that studies be conducted contrasting level of performance of those taught aural-oral language skills only with those taught aural-oral, visual-graphic skills practically simultaneously in the learning of English as a second language.

Further study also seems to be indicated to determine whether there is a progression of change in visual perception as languages become more unique in their graphic, language-representational symbols. A study should be conducted comparing the visual perception

of those using the Latin alphabet with those using a non-Latin alphabet.

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APPENDIX A

A BREAKDOWN OF SUBJECTS EMPLOYED FOR THE STUDY SHOWING TOTALS OF EACH CLASS AND NUMBERS OF BOYS AND GIRLS COMPRISING EACH GROUP

Subjects	New Jersey (EML)	Puerto Rico (EFL)
Boys	10	17
Girls	11	17
Total	21	34
Boys	10	12
Girls	10	13
Total	20	25
Boys	11	
Girls	11	
Total	22	
Combined totals	63	59

APPENDIX B

RAW DATA ON SUBJECTS

B.1. RAW DATA OF EFL SUBJECTS (BOYS)

Subject	Reading	Spelling	C.A. in months	Test score
1	4	4	105	52
2	5	4	112	72
3	3	3	102	60
4	5	4	87	62
5	4	4	93	62
6	3	3	104	58
7	2	2	85	60
8	4	4	98	77
9	4	4	88	83
10	4	4	97	80
11	3	3	96	69
12	5	4	93	87
13	1	1	99	51
14	3	3	90	80
15	2	2	96	65
16	3	3	92	47
17	2	3	99	68
18	4	3	89	75
19	3	3	86	81
20	5	5	94	87
21	4	3	96	65
22	5	4	97	70
23	3	2	89	74
24	2	1	92	60
25	5	4	96	83
26	3	2	86	68
27	1	1	96	59
28	4	4	90	89
29	4	3	93	73
Totals	100	90	2734	2017

B.2. RAW DATA OF EFL SUBJECTS (GIRLS)

Subject	Reading	Spelling	C.A. in months	Test score
1	5	4	89	71
2	5	4	86	73
3	5	4	98	70
4	4	4	86	84
5	5	5	91	70
6	3	3	83	76
7	4	4	89	74
8	4	4	118	71
9	3	3	93	72
10	4	4	86	67
11	4	4	90	71
12	5	4	90	74
13	3	3	95	74
14	4	4	89	67
15	2	2	98	43
16	4	4	92	88
17	4	4	90	85
18	2	1	100	65
19	4	3	95	78
20	3	2	94	65
21	2	1	87	79
22	4	4	93	84
23	2	2	88	70
24	3	3	95	85
25	4	4	95	89
26	3	2	87	52
27	4	2	93	66
28	3	3	114	72
29	4	5	91	76
30	2	2	97	79
Totals	108	99	2792	2190

B.3. RAW DATA OF ENL SUBJECTS (BOYS)

Subject	Reading	Spelling	C.A. in months	Test score
1	4	3	90	74
2	1	1	94	79
3	1	1	91	82
4	1	1	98	81
5	2	2	95	64
6	3	3	92	87
7	3	3	92	57
8	5	5	90	81
9	4	3	89	76
10	4	4	91	91
11	1	1	90	2
12	3	3	99	74
13	4	4	94	76
14	4	3	95	74
15	1	1	89	69
16	4	4	94	81
17	3	3	91	73
18	4	3	98	79
19	3	2	86	78
20	4	4	95	79
21	4	4	89	80
22	4	3	90	83
23	3	3	95	79
24	3	3	100	87
25	3	3	95	71
26	2	2	92	79
27	2	2	92	81
28	2	2	94	68
29	4	4	107	80
30	4	4	91	87
31	3	3	112	58
Totals	93	87	2910	2310

B.4. RAW DATA OF ENL SUBJECTS (GIRLS)

Subject	Reading	Spelling	C.A. in months	Test score
1	4	4	95	76
2	3	3	90	47
3	5	5	93	88
4	4	3	89	75
5	4	4	89	55
6	4	3	93	65
7	3	3	89	77
8	1	2	90	59
9	3	3	91	74
10	1	2	89	38
11	1	2	101	64
12	4	4	96	50
13	3	3	91	66
14	4	4	99	82
15	4	3	87	79
16	3	3	100	80
17	4	4	99	78
18	4	4	92	77
19	3	2	88	70
20	4	2	97	74
21	3	3	92	83
22	2	2	90	81
23	5	4	95	79
24	4	3	87	76
25	5	4	98	93
26	5	4	97	82
27	5	4	90	81
28	3	2	90	89
29	3	3	96	81
30	5	4	92	88
31	2	3	90	80
32	2	2	97	66
Totals	110	101	2972	2353

B.5. SPLIT-HALF SCORES OF SUBJECTS

Sub-ject	ENL Boys Odd	ENL Boys Even	ENL Girls Odd	ENL Girls Even	Sub-ject	EFL Boys Odd	EFL Boys Even	EFL Girls Odd	EFL Girls Even
1	37	37	36	40	1	25	27	35	36
2	41	38	24	23	2	35	37	42	31
3	44	38	43	45	3	31	29	36	34
4	41	40	39	36	4	29	33	42	42
5	36	28	28	27	5	34	28	34	36
6	44	43	32	33	6	31	27	36	40
7	28	29	40	37	7	29	31	37	37
8	42	39	31	28	8	40	37	35	36
9	37	39	36	38	9	42	41	39	33
10	49	42	18	20	10	41	39	34	33
11	1	1	29	35	11	33	36	33	38
12	35	39	27	23	12	43	44	34	40
13	39	37	31	35	13	29	22	37	37
14	36	38	42	40	14	41	39	32	35
15	37	32	39	40	15	32	33	20	23
16	40	41	42	38	16	26	21	44	44
17	37	36	38	40	17	33	35	44	41
18	40	39	41	36	18	41	34	30	35
19	38	40	38	32	19	42	39	38	40
20	42	37	37	37	20	44	43	33	32
21	41	39	41	42	21	33	32	37	42
22	43	40	38	43	22	35	35	43	41
23	40	39	39	40	23	38	36	39	31
24	43	44	39	37	24	32	28	44	41
25	33	38	47	46	25	44	39	45	44
26	37	42	39	43	26	33	35	27	25
27	42	39	39	42	27	34	25	34	32
28	36	32	43	46	28	43	46	37	35
29	43	37	41	40	29	38	35	39	37
30	46	41	45	43	30			38	41
31	33	25	39	41	Total	1031	986	1098	1092
32			32	34					
Total	1181	1129	1173	1180					

Groups	ENL	EFL
Odd	2354	2129
Even	2309	2078
Totals	4663	4207

APPENDIX C

TEST MATERIALS

C.1. TEST FORM

Test 2 A
Figure & Ground

Work down each of the ten columns separately.

STOP

Reading ability:
Very good ___
Good ___
Average ___
Poor ___
Nonreader ___

Last report card
spelling grade ___

Name _____

Birth date: Month___ Day___ Year___

Boy___ Girl___

C.2. ENGLISH TEST DIRECTIONS

1. Do not have alphabet or numerals on display.

2. Use crayons.

3. Distribute test sheets. Children write their names.

4. Say: In these puzzles you will sometimes see a capital letter, sometimes a small letter, sometimes a number, and sometimes you won't see anything. Now do this quietly, children. Look at Puzzle Number 1. If you see something, take your crayon; follow the dots with it so that it looks like what you saw. Go ahead. (Give some time). Now children, did anyone see anything? (Have a child write on board what he saw). Ask, "Did anyone see something else?"

5. Say: Do the other puzzles like this first one. Remember, write the first letter or number that you saw if two ideas come to your mind. Work quickly. Do the easy ones first; then go back to do any you skipped. (Allow one-half hour. Collect papers as children finish.)

6. Teacher, on each test form, please supply needed data by checking appropriate blank:

   Boy___ Girl___

   Reading ability:

   Very good___ Good___ Fair___ Poor___ Nonreader___

7. Last report card spelling grade.

8. Please fill in child's birth date:

   Month_____ Day_____ Year_____.

9. Thank you.

C.3. TEST DIRECTIONS WITH INSTRUCTIONS IN SPANISH FOR PUERTO RICAN SUBJECTS

1. Do not have alphabet or numerals on display.

2. Use crayons.

3. Distribute test sheets. Children write their names.

4. (Diga): En estos rompecabezas verán a veces una letra mayúscula, a veces una letra minúscula y a veces un número. Otras veces no verán nada.
   Niños, ahora hagan lo siguiente silenciosamente: Miren el rompecabezas número 1. Si ven algo tomen su crayola, marquen siguiendo los puntos hasta que quede dibujado lo que han visto. Háganlo ahora.
   (Déle algún tiempo para trabajarlo. Luego diga):
   Niños, ahora díganme lo que vieron.
   (Permita a algún niño ilusrar en la pizarra lo que vió. Luego pregunte: ¿Alguno de Uds. vió algo distinto?)

5. (Diga): Hagan los otros rompecabezas como hicieron el primero. Recuerden, escriban la primera letra o número que vean; si vienen dos ideas a su mente. Trabajen rápidamente. Hagan los más fáciles primero. Luego vuelvan atrás a hacer los que habían dejado sin hacer.
   (Permita media hora de tiempo para el trabajo. Recoja los papeles según vayan terminando.)

6. Teacher, on each test form, please supply needed data by checking appropriate blank:

   Boy___ Girl___

   Reading ability:

   Very good___ Good___ Fair___ Poor___ Nonreader___

7. Last report card spelling grade.

8. Please fill in child's birth date:

   Month_____ Day_____ Year_____

9. Thank you.

C.4. TEST ANSWER KEY

Item	1	2	3	4	5	6	7	8	9	10
1	R	9	4	h	2	V	8	P	e	3
2	A	F	K	P	E	4	J	2	S	H
3	8	d	2	G	4	H	K	V	J	0
4	0	P	S	Z	8	d	D	f	G	4
5	L	V	A	5	A	2	5	z	9	A

	1	2	3	4	5	6	7	8	9	10
1	J	3	X	V	h	S	V	4	0	2
2	2	A	e	J	I	P	L	H	K	5
3	X	L	P	9	0	0	9	5	L	P
4	Z	0	6	E	P	5	R	3	K	K
5	D	4	5	3	X	e	F	R	X	d

C.5. METHOD OF DATA COMPILATION (SAMPLE)

Key	R	9	4	h	2	V	8	P	e	3	A	F	K	P	E	4	J	2	S	H	
Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Pupil																					Totals
1. R.M.	R	9	4	ϟ	2	✓	8	P	✓	3	A	F	K	P	E	4	⌀	2	S	H	16
2. J.V.	R	9	4	ϟ	2	V	8	P	⌀	3	A	F	K	P	E	4	J	2	S	H	18
3. R.P.	R	9	4	ϟ	2	V	⌀	P	⌀	⌀	A	F	K	P	E	4	J	Z	S	H	15
4. D.E.	R	9	4	⌀	⌀	✓	8	P	e	3	✗	F	K	P	E	4	J	2	S	H	16
5. D.S.	R	9	4	h	⌀	V	⌀	⌀	⌀	⌀	A	⌀	K	P	E	✗	J	Z	S	H	12
6. A.H.	R	9	4	h	2	V	8	P	e	3	A	F	K	P	E	4	J	2	S	H	20
7. V.J.	R	9	4	h	⌀	V	⌀	⌀	⌀	⌀	A	F	K	P	⌀	4	⌀	⌀	S	✗	11
8. P.R.	R	9	4	⌀	2	V	8	P	⌀	3	A	F	K	P	E	✗	J	2	S	H	17
9. T.J.	R	⌀	4	ϟ	⌀	⌀	⌀	P	⌀	3	A	F	K	P	E	✗	⌀	2	S	H	12
10. D.B.	R	9	4	h	2	V	8	P	e	3	A	F	K	P	E	4	J	2	S	H	20
11. C.G.	/	/	4	/	/	/	/	/	/	3	/	/	/	/	/	/	/	/	/	/	2
.																					
.																					
.																					
Totals	10	9	11	4	6	7	6	8	3	8	9	9	10	10	9	7	7	7	10	9	159

APPENDIX C.6.

A DISPLAY OF INDIVIDUAL TEST RESPONSES SHOWING KEY RESPONSE, ITEM NUMBER, INCORRECT RESPONSE OR OMISSION (/), AND TOTAL CORRECT

C.6. TEST RESPONSES FOR EFL GIRLS

Pupil	R	9	4	h	2	V	8	p	e	3	A	F	K	P	E	4	J	2	5	H	8	d	2	G	4
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1				S	8				G	S												8	∂		
2		ɔ		n	R			D	/	5							5				0	8			A
3		8			Ɛ	Δ			X	5							i					8		6	N
4				]					O							Δ						8		C	
5		O		8	8			D	8	5											0	8			
6		8					O		G	5							ɔ					8	O		A
7				S					/	S												8			
8				M	z	∇			G							R	9		5			8		6	A
9	P			D		z			z	5			D			A						8			
10					8				/	S							8	b	B			8			
11		8		ʎ					b	5		R										/			A
12		O			z				G													S		c	
13				S	8	C			G	5												8		C	
14		8			8				b	S	∧						8	8				8			A
15		8			8	∇	S	B	b	S		R	C		5		ɔ					8	e	c	V
16					8				c								8						6		
17					n	9			L	5												8			
18						8	L	O	B	6						H	9	d				O			T
19					S	8				6	S						T					S			
20			8		ɔ		Y		B	6	5					A		z		4		I	z	C	A
21					I	z		M										8				Q			M
22						8				6						A						S		6	A
23			8		S			O		B								a				8		d	
24										v	5											8			
25								Y														8			M
26	88	ɔ		S	B	1	Y			O	5				L	B	I	8	ə	ə	3	8	8		C	A
27				S	C					O												8	8	C	A
28	U			J			O			6	5						A		d			8		C	X
29		ɔ	A	I						b									5			8		C	
30				/	9		O		I	O								9				O			

Pupil	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
1	K	E			G		R			S						2				F	7			C	K
2			N				R						/			2	N		15				∑	/	
3	K	V			C		B			S	ε		T			2		C	15	Δ				8	
4		L					B			S						A			15	Δ					
5		V	N	V	C					S				C	A	2			b	4				C	
6		V		4	C		B			B			2	C		2								E	
7	/	/	U				B	/			8					Z			15	/				/	
8			N	4	e	⊖				S	D					ε	N		15					5	
9		L	N	d			R			S			1		1	7			15					S	)
10			K				B				2				8	ε			G	15	+				
11		/	N	/			R						T	C		1			H					8	
12	/	L	N	/						S				C					C	D	/			/	
13	1			K			R			S										16	4	?		5	
14	L						R			G	8					2			6					9	
15	k	V	II	☽	ə	C	R		/	/			/			C		/	/	/	2			/	
16	K		N				R																		
17	L			1			R			S									G					O	
18		V	Y	V			R						d			2								S	K
19		V	N				B			S										E				5	
20	4	U	U			6	B	5			8		2		Y	1				4				5	D
21	U	ε		V			B			S			T	C						Δ				8	
22	h													C	J										
23	R	L			⊃					S			T						b	Δ				8	X
24	K						B			S			T						D	Δ					
25	1	L					B			T										Δ					
26	/	✕		7						6	5		T			ε	N			Δ		0	7		
27		L		V			R			S	8		E	C	A				b	Δ				5	
28	1	1					R			3				O			N		b	Δ					
29		1		1			R			S			T		A	P								O	
30	K	L		V						S			T	C					b			⊃		8	

pi	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77
	J	3	X	V	h	s	V	4	0	2	2	A	e	J	▯	P	L	H	K	5	X	L	P	9	0	0	9
1					A						8				)							E					
2								/			R				D												
3									b						L			14									
4														I	L				b								
5					b						R		O	I	Z												
6															D												
7								I							/		D	4	b								s
8									G			B		I	X			N									s
9						A								I	L			14									
10					Q									I		R	D	14	b			7	e		6		
11	O									3				I				/	Y								9
12					Y	b					2				L												
13																		14	b				e		Q		o
14	8				Y						2				T	L		D	G				R				o
15	/				B			C			/	/	/	T	/		/	4		J	/	B					
16															L			4	b								
17																											
18							H				R				T	V		e	14	5							5
19															T	L			4								
20					4		U					4								5			ɔ				
21													9		T												o
22							Z								L												
23						3				O	4				I	Δ	R		4	Y							
24															I	L			K								
25																			4								
26	8				R	3	∇								J		C		4	Y							
27	Δ				4	3		Δ				⋀			T	L	V		∀				8	Q			
28									O	Λ					T				14	X							
29							A								I												
30					1														4								

Pupil	5 78	L 79	P 80	Z 81	O 82	6 83	E 84	P 85	5 86	R 87	3 88	K 89	K 90	D 91	4 92	5 93	3 94	X 95	e 96	F 97	R 98	X 99	d 100	Total Correct
1				7	G	G			2						A		5			V		2	O	71
2			D					E									ɔ		O					73
3			D			G		R	2								5						6	70
4								R											O					84
5					G	P			7	X			M							P				70
6			D			G	P		9														O	76
7			D			G	zR					/					5							74
8								P									5						O	71
9						G		)	K				1				O							72
10	ℓ		8			G	P		8	U		O								R			8	67
11		b	2			G		R				X											8	71
12						G	P	z		P		X	/										O	74
13			8					R		P		b					5						¢	74
14			G				P	R				X	R				5			5			O	67
15	/	D	/	/	/	/	)	ε	/			/		D			G						/	43
16						G																		88
17			O			G	Z		Z															85
18	4		8			G		E	Z			6	6				O			e				65
19			7			G	P	R				X					5						5	78
20	4		3							P		X												65
21						G			5			X												79
22									2	P		X									P		6	84
23							z		7	P		X	)				O							70
24										X		Y											O	85
25								R				L												89
26				8			[	\	8	Y		X	▯				O		O				B	52
27				8					R	P							5						C	66
28				2					2			X					5			P				72
29				7		C		R	1				)				5						O	76
30							P		8				1											79

C.6. TEST RESPONSES FOR EFL BOYS

Pupil	R	9	4	h	2	V	8	P	e	3	A	F	K	P	E	4	J	2	S	H	8	d	2	G	4
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1					∂		∂	B	G	5						0	2	9			5	S		C	M
2				/	∂		B		/	5								4				8	5	2	S
3					∂		/	B	B	S			R			Λ	/	D				8		8	A
4				5	S	L		B									S		8		3	8		6	
5				S	S	L		G			5					A	∂					S			A
6				/	/		/		6	/							/	/	/			S		6	
7		∂	z				G		6	S						G	8	S				8	8	(	A
8					/	/	3		6	5												8			
9		∂				z			V													8		C	
10									G	5												8			
11	ɔ			S					G							2					8	8			M
12							0		0													/			
13					/	/	/		/	5						/	/					8		/	A
14					b				6	S														6	
15					5				/	S							/					8		/	N
16	B	∂			S	E		F	A	6	S			R		A	/	d	8	11		8	ſ	L	A
17	P				n	/	Y			X						X						8	/	/	
18		ɔ			n	9	7			b	5											8			
19					5			∂		/												8		C	
20																								C	
21		S		5		Y	∂	B	5	J							3					8		∂	Δ
22					1			0		V	5					X			8			8	0	C	M
23					1			3		9										P		8			X
24		/		/	/			/		/	/					/	/					5		/	
25										0	S											1		6	
26	ℜ				S	S		0		6	5	/	E									8		C	F
27					/	/	z	/		/	/							/	z	/	1	/		/	
28										/												S			
29					J	b										A		T				S		C	

Pipi	H	K	V	J	O	O	P	S	Z	8	d	D	f	G	4	L	V	A	5	A	2	5	Z	9	A
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
1		↖	U	ć	G		B			S	⍺		T			Ɛ				G			▷	ϑ	
2	/	/	N							S					A	I		Λ	15					/	
3			V				R			S			T				N		F				Ɛ	?	
4	T	⍺			U		R			S	8			◁	D	2		Λ		4				Ɛ	
5		⇗	N		G					S	8					2	N	Φ	15	Δ				3	
6		/		/	/					G					/				15					/	/
7			N	↓	Ɛ					S	S		I	C		2			S	4				R	
8				/	↳	Q	B			S	8		t	c					15			3			
9										S										4		3			
10				/			B			S	⍺			C					6					D	X
11		/	M		D		B			S				C		Ɛ	M	C	15	⍺				5	
12	K				C		R			S				Q											
13	/	/	/	/	/		R			S	/		/			/			15		/	/		/	/
14		6	N		d					S					9		N	6							
15	R	/	N	/			B			/			/	D		2				Δ				/	
16	N	⍼	N	U							8		L	O	I	2	N				⍺	ↄ	O	8	
17	R		Y	I			R		F	S			T		A				15					5	
18	I	L		I			B						T							Δ			7		X
19	⬭	V			/	G	B		7				T						b	4				/	
20	F	L					B			S			T											O	
21	∞	V		⌋	O		B			S	8		I			Ɛ							9	/	
22		L		I	U								T	O	I				b				7	ϑ	
23	Я	L					R						T						6					O	
24	I	b	N	I			B			/			T				/		6	4	/		/	K	
25	I						R			S			I											2	
26	/	V		/							/			I	Ɛ		Λ		Δ		O	7	/		
27	I	I		⌋	/		B			/	I		/			/	/		D	Δ			7		
28		L											T			N	4	b		4					
29	S	L					R			S	8		T					Δ		⍭		<		O	4

Pupil	J	3	X	V	h	S	V	4	0	2	2	A	e	J	▯	P	L	H	K	5	X	L	P	9	0	0	9
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77
1	9				G	5		Δ	6		9	F		T	Δ		U	4						D		Q		
2			K												/	R		4										
3								A		/	9			I	Δ			И	b						C		
4						3					9		C	|			▯	L	|								
5						8			6		3			I	D		4	14		S						C	
6					/	/				/	/	/		I	/	R	/	K	/	/								
7	d			X				5	◻				C	I	L									?				
8											8				/	R												
9							U					4		|	⊥					3								
10														|	L			k									
11											R			I	|				R	S							
12														|	L			4									
13	/		/	/		/	/		/	/	/			I	|	/	/	/	/			/		/	/	/	/	
14											R				b			d						X				
15					5						R				D		4	|		3		/						
16			U								R			C	4	D		A	K	S		B	R		9			
17						Y					R				X	e	X	14	И						8			
18														J				|										
19						/									G			4										
20									L						L			4										
21				A	5				L						λ								2			Q		
22														I	|		D	⫴									
23				⫴						3	Δ				L			4										
24			U	/						/				I	/			14								S		
25				∩											0			|										
26							V				Δ				|	R							?	?				
27				/	6					/				I	|		I	4				/			X		
28															L													
29				T						9								14				4						

Pupil	5 78	L 79	P 80	Z 81	O 82	6 83	E 84	P 85	5 86	R 87	3 88	K 89	K 90	D 91	4 92	5 93	3 94	X 95	e 96	F 97	R 98	X 99	d 100	Total Correct
1		V				G	P	L	ↄ	B	5						5		O	H			D	52
2			b			G	P	R				X												72
3			D	8		G	P	D	R	#		b							O	5			b	60
4		5				C	P		2	P		X	R							P	P		O	62
5	3		D	3			P		8			X	H				5						X	62
6		/	/	3		G	P		/			/	/				5			/		/	/	58
7	S					G			2	F		/				S	S			V			℟	60
8			D						S				/										/	77
9					⌀				d			X											G	83
10			D					X	2	/		X											6	80
11									ↄ			/				S	S			R			O	69
12						G						X												87
13	/		/						/	/	/	/	/											51
14						G						b	b				5						6	80
15		/	/	7		G		R				X					5		C				/	65
16				S	b	C	R		B	A	5	A						8					O	47
17				3		G			9			b		P										68
18		4	D	7	⌀	G		R	2														O	75
19																							C	81
20						G			2	/														87
21				7					9			X	1				0		0				b	65
22						G			℟	N	5	X					5		O					70
23				7		G	T		Z			X					5		X	7			O	74
24	/	/		3		G	P	R	2			A					ↄ		C				/	60
25				3			P		Z								5		O					83
26									/			X					/						/	68
27					P		P		2			/	/				ↄ						/	59
28						G		R																89
29						G	I	R	9			I											b	73

C.6. TEST RESPONSES FOR ENL GIRLS

Pupil	R	9	4	h	2	V	8	P	e	3	A	F	K	P	E	4	J	2	S	H	8	d	2	G	4
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1					3	9	Y		V								g	8	5			8			
2		g				g	Y	S	/	/							/	Z			g	8			G
3							O		O										5			6			
4	/	/	/	S					4		/	/	/	/	/	Δ						8			
5				S	e		G		C	S						7	S			B		8	g	C	X
6		L		S	8	7			V	5							8					8			W
7				S	g				K								9	8				8		e	X
8				S					G	S			R	I			B	T		A		8		6	N
9				S		S		L	B	K	S									h		S		U	
10				S	/	/	/	/	/	/	/	/	8	/	/	8	/	/	/	/	/	/	/	/	/	/
11		5		S	8	L	2				/	/					/	/	/	/		8			/
12		/		/	/	/					/	/										/		6	/
13				S	Z		Q				/	/					/	/			E	E			A
14				S				9		Y								2				8			/
15				S		Y		/		6								/				8			A
16				S	7	L				/						A						8			
17				I	/		Q			7							/				S	8		/	
18		/		/	/		/		/	O												8			
19				I	9	Z		B	V								/	9				8		5	N
20				I	L		O		O	5								/			S	S	2	C	
21				S	3				6													8		C	
22	F	2		S					/													8			W
23				S	8		/		/													8			
24		S		S					L	S												8			
25				I																		S			
26				S					Z													S			
27									K	5							S								M
28				S					9												3	8			
29									/													8			A
30									R																
31	3			I			e		9	5												S	8		
32		g		3						G	S	4				Δ	2					8	8		

Rpi	H	K	V	J	O	O	B	S	Z	8	d	D	f	G	4	L	V	A	5	A	2	5	z	9	A
	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
1		Y		Y						S	B			C		2								0	⊕
2		/	/	/	/	/				//		//		//		/	/	/		//				/	
3		L								S		T							0						
4	K		N	K			R									2			4						
5		♥	U	V	&		P			S	Q	T		A		E		G	13	4					⊼⊠
6		N		▮			R			S	B	I				E				4			7	D	
7	K	L		U			C			S	8					E				4				5	
8	X	⌄	◪	U						S	B			A		E	B	L	15	⌄			⅄	5	⊕
9		V	N			6				O		T				D				Δ				ↄ	
10	8	/	/	/	/	/	/	J	/	/	/	/	/	/	/	/	/	/	8	⅄	/	/	/	/	/
11			/	/	/	G	R			S	B									∧				Γ	
12	/	L	/	/	/	Θ				C	D				a				S		/		/	/	
13			/	/	/		R			S	B					E					/		/	/	
14		V			U						B							C		4				5	
15	⊖	/	/	/						S						2				Δ				/	
16			N		/		P													⌄				/	
17	/			/	/		R			S					A	2									
18		/	N	/	8												N			/				/	
19	/		N	/	G	C	R			S	a						N								
20				V	G		P				O														O
21		C					R			S					A	2									ↄ
22			V		/	/				S	B	T				2				9				/	
23	K	V			/	/											M							S	
24	K		I		V											2	N		D	Δ				S	
25										S									D						
26	h	L		k	C		R			S						2			F					S	
27	k	V	U										C				Q							O	
28																				4		Q		O	
29					U					S									15				7	⅄	
30	K		⅄		G					S						2				4				5	
31		L		V						S	B									F				e	
32	E	E					R			S			C			R				Δ				S	

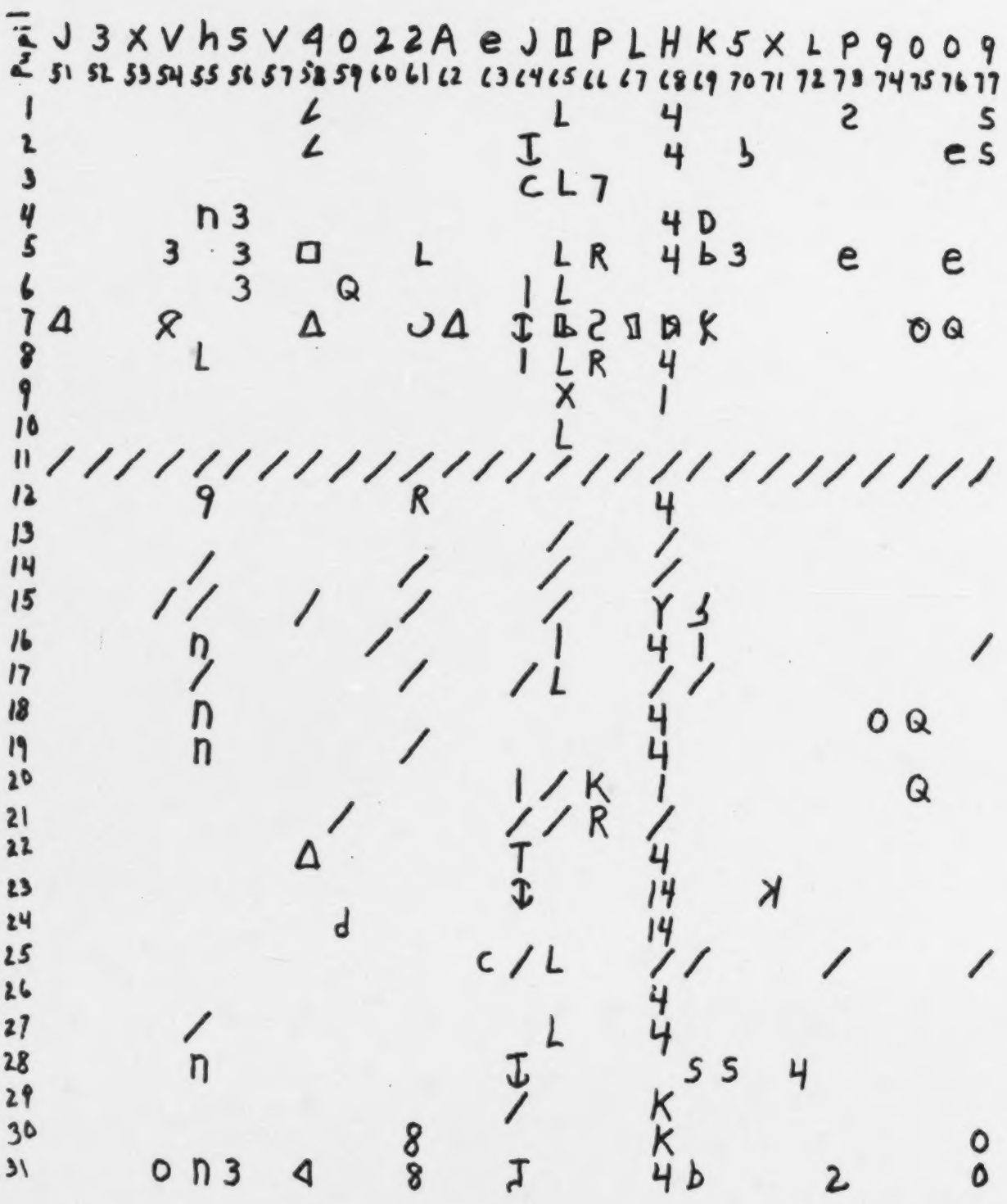
Pupil	J	3	X	V	h	S	V	4	0	2	2	A	e	J	D	P	L	H	K	5	X	L	P	9	0	0	9
	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77
1											3							9					2				
2				/		/		/			/	/		I	/	/		/	/		/		D		/	/	
3															L												
4												9		T	4												
5	⅄										3	∧		T	B			0	S								S
6	Δ				3									I	L								?				9
7					R																						
8	⅄										3	X		⊓				⊔									
9					n												▯	9	6								
10	R				n			/						I	⅄			A									
11															L	R		9	b								
12	/	/	/	/	/	/	/	/	/	/					/	/		/	/	S							
13								/							/			/	/								
14															L			14									
15											/							/									
16					/										7			M						Θ			
17					n										L												
18					/	8								/	I				1								
19														1	L	R		1									
20											0			1	L			4						0		0	
21					n										⅃	R											
22					H										L												
23					Q									U	/		D	9									
24	8													I	L				0								
25														1	L												
26											R				L			4									
27																R		K									
28															S			4									
29											/				/	R			3								
30																			3								
31														1	)												
32					n									1	9			U									

Pupil	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	Total Correct
1							I	L	B			^											8	76
2				8	/	/	[	E	/	/	/	/	/		ε						⊓		/	47
3				7																	P		0	88
4							R	8									5						6	75
5				3	10		R	S	P	S	ε	x											ε	55
6			O			C	Z	⊓	8				N				O		O	5			0	65
7			D				3		B								5						0	77
8	4			8			R		2	V		X											0	59
9		4			ø		7			A			L											74
10		1	D					R	D	B		⋂							/			8		38
11		4	D			Y		R											4	/	/			64
12		4	D			G			/	/	/	/	/				ɔ		/			0		50
13		/		3		G			/		/	/	/				/					/		66
14			D				P		8													5		82
15									/			/	Y				ɔ							79
16				7				R	2				D									0		80
17									/			/					0					/		78
18							Z		/			/										/		77
19							L		2			∧					5					0		70
20						C		R	Z								5							74
21							P	R														0		83
22								R														/		81
23									/			b					5					/		79
24							Z	Z	Z								0		A			C		76
25						G																		93
26						G		X											/					82
27				3			P				O								5					81
28	S																5							89
29	/				10			R	9			/												81
30							L		2													/		88
31							P		)								5					S		80
32									8		5		L				5		P					66

C.6. TEST RESPONSES FOR ENL BOYS

Pupil	R 1	9 2	4 3	h 4	2 5	V 6	8 7	P 8	e 9	3 10	A 11	F 12	K 13	P 14	E 15	4 16	J 17	2 18	S 19	H 20	8 21	d 22	2 23	G 24	4 25
1				S		A			V								S					8		6	A
2				1					O													8		e	
3				S			O		6	5								Z				8			
4				9	9	Y					Ь	Δ										d			
5					g		α	B	6	5		6			A			2				8		C	
6																						S			
7			9		3	B	B	5						[		g		ə		4		8	g	c	A
8				1					b													d			
9		O		~	Z	T	O		L							A	2					8			
10									/		/											J			
11	/	/	/	/	/	/	/	/	/		/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
12				ℜ	8		3		O	g												8			N
13				/			/		/													S			
14				/	/	/	/		/	/												/		/	
15					9				V	S	Λ	T										8		O	A
16				/			/		/	S															
17		/		/			/		/	/												8		/	
18				S			d		b	S														C	
19				S	9				6													8			A
20				/			/		/	/				F								1			
21		/		/	9				/																
22				S					G	S								Z				8			
23		O		S	O	2			R									Z						C	
24							O		O													8		6	
25					C			8																	
26				٦					G	5								S	8			8		e	X
27		O		S	7				6									9	//			S			X
28				8			O		/	S											Y	8		C	
29					8	t			X	S								S	8			8			
30				٦				B	ß													8			
31		8		∩			ξξ	3		ə						Δ	3	R			4	8		C	

Pupil	H 26	K 27	V 28	J 29	O 30	O 31	B 32	S 33	Z 34	8 35	d 36	D 37	f 38	G 39	4 40	L 41	V 42	A 43	5 44	A 45	2 46	5 47	2 48	9 49	A 50
1	K			K			R									Ε				4		3	7	0	
2	ᔑ	L			G					S						2							5		
3				I	C		R			S			T			2									
4		Y											I					Δ					8		
5	K	L								S	A		P			2	U			Δ				S	
6				I	U		P			S									b					O	
7	K	Y		d	⊖					S	8					Ε			25	4				ᔑ	
8	I	I											T			I			b				7		
9		Y			C		R			S			T	C		2				4		0	7		
10													T										7		
11	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
12				K						S	a			0		2				4				ς	
13	/	/		/	/		R			S	I								/	/			/	/	
14	/	/		/	/					S						/	/		/	/			/	/	
15	ᔑ		N				P		7							2						9		e	
16				/	/		P			S						I	b							/	
17	/	/		/	/		P				/					/								/	
18	n		U	V						S	a					2								5	
19		V	e	/	U		R			S				/						5	L		7	8	
20	I			/	/		P						T	C						I				/	
21	/			/	/		R			S										b	/			/	
22		V				U	R			S						2								O	
23				V						S				O		S							7	5	
24	ᔑ									S						2				Δ					
25				K										C		I				b				/	
26		L								S	O					ς				4				C	
27													T			2									
28		L									8		F			2			15					⌐	
29	k				U		P			S						2	N						7	e	
30	k															B							7	R	
31	h	Ε	Ш				8		Ε	8				C		Ε	N	4		Δ				S	4



Pupil	5 78	L 79	P 80	Z 81	O 82	6 83	E 84	P 85	5 86	R 87	3 88	K 89	K 90	D 91	4 92	5 93	3 94	X 95	e 96	F 97	R 98	X 99	d 100	Total Correct
1		4		7					2				6				5						6	74
2		4			Ø												ɔ			5			9	79
3									9								S						1	82
4							P			P			Y				0				D			81
5					5		R		Z			X								5			5	64
6									S			X												87
7		4				G	e		Я			X					5						6	57
8						C	P													P			0	81
9						G						V									P			76
10							Z		2														0	91
11	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	2
12		D				P	R	8				X	Y				5						8	74
13							R	/		/	/	/											/	76
14			/				R	Z			/	/											/	74
15		O				P	R	S				Я					O	O					O	69
16						G	L																	81
17			7					/				/	/										/	73
18		4				P		9															S	79
19								9				6												78
20								/				/											d	79
21		4				G		/									5							80
22												X					5						0	83
23						G	P						Q										8	79
24						G			Я			X												87
25	/	/	/			/		/	/	/	/					/	/	/	/	/	/		/	71
26		4				G	F	R				X											0	79
27						G		R	2		J						ɔ						5	81
28		4	R	8	Ø	G		R	8		J	P					8		P	n			0	68
29						G			Z														0	80
30									Z														Я	87
31			O			G		Я	Ɛ								O		O	E				58